by 142 to 129, and was afterwards adopted as a substantive motion by 144 to 116

EDINBURGH.—Lord Zetland has intimated that with the sum, amounting to between 4,000*l*. and 5,000*l*., which he has received as compensation for the abolition of patronage in Orkney and Shetland, he intends to found several bursaries in connection with the Faculty of Arts in Edinburgh University. His lordship, in so disposing of the money, has in view the advancement of the educational interests of Orkney and Shetland, of either of which the intending bursars must be natives.

## *SOCIETIES AND ACADEMIES*

### LONDON

**Royal Society**, April 12.—"On the Constant Vibration of Minute Bubbles." By Walter Noel Hartley, F.R.S.E., King's College, London.

Those who have given great attention to the study of fluid cavities in minerals, have occasionally met with vibrating particles which are apparently bubbles.

Mr. Hartley became acquainted with these at the close of last year, 1875, when Mr. P. J. Butler showed him a ruby containing a cavity partially filled with liquid carbonic acid, the bubble in which, when of small size, was in constant motion.

He also refers to a felstone containing portions of quartz with many cavities. The majority of these were water cavities, but others appeared to be empty; and in one of them Mr. Young had noticed a moving particle, supposed to be a bubble, which made its appearance only in a cold atmosphere. By dropping a little ether on the object, the evaporation cooled it sufficiently to condense a liquid in the cavity, and the moving particle was easily seen with a magnifying power of 400 diameters. By immersion in iced water, the temperature of which was 3°·5 C., the cavity had the appearance of being two-thirds filled with a liquid, the gas-bubble of course occupying the remaining space, and having a sort of trembling motion. The bubble decreased in size, and the motion became more and more rapid as the size became smaller, until it rushed up and down and across the space in which it was confined. The thought immediately occurred that this was not a gas-bubble, but a liquid in the spheroidal condition,—in all probability carbon dioxide in a perfectly dry condition, and perhaps mixed with some incondensable gas, so that its critical point was lowered.

He concludes:—I have proved that gas-bubbles in water as well as in carbonic acid, may be attracted by a source of heat giving an extremely slight rise of temperature. It is impossible to imagine a body which is not gaining or losing, or at the same time both gaining and losing heat; it is therefore impossible to imagine it entirely throughout at a uniform temperature. It is evident then that an easily movable particle which can be set in motion by exceedingly slight rises of temperature will make the transference of heat from one point to another plainly visible; I have shown that the minute bubbles in fluid-cavities are such particles; and I believe that the vibratory motions which I have described afford an ocular demonstration of the continual passage of heat through solid substances. These phenomena really make the molecular vibrations of matter plainly visible.

April 12.—"On Attraction and Repulsion of Bubbles by Heat," by Walter Noel Hartley, F.R.S.E., F.C.S., King's College, London.

The paper deals with the bubbles in fluid-cavities of crystals, and their behaviour when a source of heat is brought near them.

With regard to the attraction of bubbles by heat, the author has noticed this take place in some water-cavities when the bubbles were free to move, and no carbonic acid was present.

With regard to this second point, the repulsion of bubbles by heat, water being the only liquid. It occurs quite as frequently, if, indeed, not more so, in the specimens which the author has examined, than attraction; and it is seen to occur in cavities containing water and liquid carbonic acid.

In a paper which the author lately communicated to the Chemical Society, he has given details of experiments on certain bubbles in water-cavities, which prove that by rise of temperature the bubbles become denser than the water and sink.

Bubbles attracted by heat and those which are repelled have generally been found in separate and entirely different specimens, and it would appear most improbable that they should exist in the same piece of stone side by side.

My work, the author said, was discontinued for a long period of two months, but on being able to look over my specimens once more, I verified all my former observations, and became surprised by the following discovery:—A bubble which was repelled by a gentle heat was attracted after it had been heated more strongly, and then on cooling it was again repelled. It appeared to contain some liquid carbonic acid floating on water with the gas.

It may be considered an argument against the motions being due to any pyro-electric conditions of the minerals, that they have been noticed in crystals of fluor-spar, and that no matter in which direction sections of rock-crystal are cut, the movements are all equally well obtained.

Regarding the repulsion of gas-bubbles, two facts are striking, namely, the very slight rise of temperature (less than ½° C.) on one side of the bubble capable of causing the movement, and the great tension existing within the bubble. The gaseous contents prevent attraction by resisting the repulsion of the liquid from the wall of the cavity. Warmth at one side of the bubble results in increased tension of the gas. This being partial, causes such internal molecular disturbance before it becomes uniformly distributed, that the bubble is rolled away from the source of heat. The bubble then takes up that position consistent with the least internal pressure. In this case it is the same bubble which moves from end to end of the cavity. When repulsion is followed on rise of temperature by attraction, the *modus operandi* is the following:—Repulsion due to the circumstances above mentioned occurs until such a temperature has been reached that, in spite of the presence of gas within the bubbles, the increased vapour-tension of water becomes a motive power by reason of evaporation and condensation, the motion of course being in the reverse direction.

April 19.—"On some Figures exhibiting the Motion of Vibrating Bodies, and on a New Method for Determining the Speed of Machines," by Herbert M'Leod, F.C.S., Professor of Experimental Science, and George Sydenham Clarke, Lieut. R.E., Instructor in Geometrical Drawing in the Royal Indian Engineering College, Cooper's Hill. [See Physical Society.]

**Chemical Society**, May 3.—Dr. Gladstone in the chair.—The treasurer announced that 1,000*l*. had been placed to the credit of the Society by the son of the late fellow, Mr. Lambert.—The following papers were read:—On some points in gas analysis, by J. W. Thomas. The author finds that nitric oxide is absorbed by caustic potash and pyrogallic acid, and recommends that a known volume of pure oxygen should be introduced after the absorption of carbonic acid and any decrease of volume noted as nitric oxide. He states that an excess of caustic potash should always be present in the alkaline pyrogallate, but that too much of the latter should not be used.—On the decomposition of nitric oxide by pyrogallate of potash, by Dr. Russell and W. Lapraik. The authors state the probable action of the above reagent is to convert nitric oxide into half its volume of nitrous oxide, but simultaneously another more obscure reaction takes place, so that 58 to 76 per cent. of the gas is absorbed instead of 50 per cent.—Contributions to the history of the naphthalene series. No. 1. Nitroso-$\beta$-naphthol, by Dr. Stenhouse and Mr. Groves. Nitroso-$\beta$-naphthol was obtained by the action of nitrosyl sulphate on $\beta$-naphthol and purified by conversion into a barium compound, &c.; it crystallises in brilliant hydrated yellow needles or anhydrous orange brown plates or prisms. It melts at 109°·5 C. By treatment with dilute nitric acid mononitro-$\beta$-naphthol is obtained. By acting on the barium compound of nitroso-$\beta$-naphthol with hydrogen sulphide a precipitate is formed which, by the action of potassium dichromate, is converted into $\beta$-naphthaquinone melting at 96° C.; this substance is interesting as being the first instance of two isomeric quinones derived from the same hydrocarbon.—On asbestos cardboard and its uses in the laboratory, by W. N. Hartley. This substance resembles thick greyish cardboard and is formed principally of asbestos fibres; it can be cut or moulded (by moistening with water) into any shape, and is extremely useful for crucible supports, muffles, &c.

**Zoological Society**, May 1.—Prof. Newton, F.R.S., vice-president in the chair.—Mr. Howard Saunders exhibited and made remarks on some nests and eggs of the Orphean Warbler (*Sylvia orpheus*) from the vicinity of Malaga, Spain. Amongst the eggs in each nest were one or two of larger size, supposed to be possibly the eggs of the Cuckoo. Mr. Howard Saunders also exhibited two skins of Dupont's Lark (*Certhilauda duponti*) from the same locality.—Prof. St. George Mivart read a paper on the axial skeleton of the Pelicanidæ, selecting *Pelicanus* as his type and standard of comparison. Prof. Mivart first compared it, as regards its axial skeleton, with *Struthio*, and the other *Struthionidæ*, and then compared the other *Steganopodes* with it and with one another.—A communication was read from Dr. M. Watson, Professor of Anatomy, Owens College, Manchester, on the anatomy of *Hyæna crocuta*, in which he described the very peculiar conformation of the female generative organs of that animal.—Mr. A. G. Butler read a paper wherein he gave the description of two small collections of Heterocerous Lepidoptera from New Zealand, recently brought to England by Dr. Hector and Mr. J. D. Enys.—A communication was read from Dr. O. Finsch giving an account of a small collection of birds from the Marquesas Islands. Amongst these were three examples of a new species of Kingfisher, proposed to be called *Halcyon godeffroyi*.—A communication from Mr. Frederick Smith contained descriptions of four new species of Ichneumonidæ in the collection of the British Museum. Amongst these was a new *Bracon*, remarkable for having its ovi-positor more than nine times the length of its body. This was proposed to be called *Bracon penetratror*, and had been received from Yokohama, Japan.—Prof. A. H. Garrod read some notes on the anatomy and systematic position of the genera *Thincorus* and *Attagis*, which he considered should be referred to the Limicolæ in the neighbourhood of *Glareola* and *Cursorius*.

Geological Society, April 25.—Prof. P. Martin Duncan, F.R.S., president, in the chair.—Messrs. S. Bewsher, H. G. Bolam, Charles Thomas, and John M'Kenzie Knight were elected fellows of the Society.—On the upper limit of the essentially marine beds of the Carboniferous system, and the necessity for the establishment of a "Middle Carboniferous Group," by Prof. E. Hull, F.R.S. The author, in this paper, divided the whole of the Carboniferous rocks into successive stages from A to G inclusive, taking the Carboniferous beds of Lancashire as a type, and showed that these stages could be identified over the whole of the British Isles. It was only recently that their determination had been made in Ireland, so that until now the materials had not existed for a complete correlation of the series in the British Islands. The following is an abbreviated statement of the representative stages in descending order :

*Essentially Freshwater or Estuarine, with one or two Marine Bands.*

STAGE G.—*Upper Coal-measures* of Lancashire (2,000 feet) and other English coal-fields. Red Sandstones, &c., of Bothwell and Ayr, in Scotland. (Absent in Ireland.)

STAGE F.—*Middle Coal-measures* of Lancashire, &c., with principal coal-seams (3,000 feet). "Flat coal-series" of Scotland. Present in Ireland (Tyrone, Kilkenny).

*Essentially Marine.*

STAGE E.—"*Gannister Beds*" (Phillips), with marine shells and thin coals (2,000 feet), in Lancashire. "Pennystone series" of Coalbrook Dale, South Wales, &c. "Slaty black-band" series of Scotland. (Present in Ireland, Kilkenny, Dungannon, Lough Allen coal-fields.) Also in Belgium, Rhenish Provinces, and Silesia, with numerous marine shells.

STAGE D.—*Millstone Grit Series* of England and Wales. 3,500 feet in Lancashire ; "Moorstone Rock" of Scotland ; "Flagstone-series" of Carlow and Kilkenny ; Millstone-grit of Fermanagh and Leitrim, with coals and marine shells.

STAGE C.—*Yoredale Beds*. 3,000 feet in Lancashire ; Upper Limestones and "Lower Coal and Ironstone series" of Scotland ; Shale series of Kilkenny and Carlow ; Ironstone shales of Lough Allen, with marine shells.

STAGE B.—*Carboniferous Limestone*. Mountain Limestone of Derbyshire ; "Scaur Limestone" in Yorkshire ; "Lower Limestone" (Roman camp) of Scotland ; Carboniferous Limestone of Ireland.

STAGE A.—*Lower Limestone Shale* of England. Calciferous Sandstone series ("Tuedian," Tate) of north of England and Scotland ; Lower Carboniferous Sandstone, north of Ireland ; Lower Carboniferous slate, with Coomhola grits, with marine shells, south of Ireland. (In Scotland, estuarine or lacustrine.)

*Palæontological Results*.—On making a census of the Molluscan and other fossils from the various stages above that of the Carboniferous limestone (stage B) as determined by the palæontologist of the Geological Survey, some interesting results were obtained, showing the prevalence of marine conditions up into stage E, and a general change in the character of the fauna in the succeeding stages. Including only the area of the British Islands, it was found that no fewer than thirty-seven genera, with seventy-four or seventy-five species, of decidedly marine forms, occur in the Gannister beds (stage E), of which all the genera and about forty species were known in the stage of the Carboniferous Limestone. The series includes *Phillipsia*, which has been found by Dr. F. Römer, in the representatives of stage E in Silesia. On the other hand, of the whole number of species in stage E (Gannister beds), only six are known in the overlying stages F and G, these being characterised by the prevalence of bivalves of supposed lacustrine or estuarine habitats, variously called *Unio* and *Anthracosia*. Of the few species of marine genera known in stage F (Middle Coal-measures), about five or six species are peculiar to itself, according to the determination of the late Mr. Salter. Such a remarkable difference in the fauna of the Upper and Middle Coal-measures, as compared with that of the Gannister beds, constituted, in the author's opinion, sufficient grounds for drawing a divisional line between these two divisions of the Carboniferous series. Of the several existing methods of classification adopted by different authors, none of them appeared sufficiently to recognise the palæontological distinctions and characteristics of the several formations. The large number of genera and species which are now known to range up from the Carboniferous Limestone into the Gannister beds, and no higher, indicated the proper horizon for a divisional line, in fact a palæontological break at the top of the Gannister beds. On the other hand, the mineral and palæontological differences between the Carboniferous Limestone and the overlying Yoredale series were sufficient to justify their separation into distinct divisions ; while the Yoredale, Millstone-grit, and Gannister series are related by close mineral and palæontological resemblances. With a view, therefore, of bringing the classification of the Carboniferous series into harmony with the character of the representative faunas, and the physical features of the successive stages, the author suggests that stages C, D, and E, composed of essentially marine beds, should be united into a Middle Carboniferous group ; while stages F and G would remain as at present, in the Upper Carboniferous, their fauna being essentially of fresh water. In the discussion which followed, Professors Ramsay, Boyd-Dawkins, Prestwich, and Hughes seemed to doubt the feasibility of permanently maintaining the lines of demarcation laid down in the paper.—On coal-pebbles and their derivation, by H. K. Jordan, F.G.S.

Physical Society, April 28.—Prof. G. C. Foster, president, in the chair.—Mr. W. Ackroyd described some methods of studying selective absorption in relation to the doctrine of aggregation. After referring to the absorption of iodine vapour and iodine violet solutions he showed that an analogy exists between these solutions and the aniline dyes, and a method was indicated by which the approximate size of the particles affecting light might be estimated.—Prof. H. McLeod exhibited several forms of apparatus which he has, in conjunction with Lieut. G. S. Clarke, R.E., arranged for determining the speed of machinery, &c., from observations made on the figures produced by combining their motion with that of a vibrating body ; a description of them has already been communicated to the Royal Society. If a uniformly-moving point of light be reflected from a mirror attached to a tuning-fork vibrating in a plane at right-angles to the motion of the point, the reflected image will appear as an ordinary single wave, and a double figure of the form of a series of figures of eight, caused by the overlapping of two waves, will be formed if a series of points of light move uniformly with such a velocity that a point passes over two intervals during an odd number of vibrations of the fork. If equidistant perforations be made in a circle on a disc which is attached to a rotating axis and the number of vibrations of the fork be known, the form of figure reflected on to the screen will, theoretically, give the requisite data for determining the rate of rotation of the disc, and further, a slight increase or decrease in this rate causes the figure slowly to move in the same or opposite direction to the disc. If the fork make 3,600 vibrations and the disc 100 revolutions per minute, the circle must be divided into seventy-two equal intervals, but for such a number as 101 revolutions 71·287 intervals are needed. This fact would introduce some difficulty in preparing an apparatus for measuring the velocity of rotation so as to give the speed in whole numbers per minute, but it may be obviated by ruling convergent white lines on dark paper and so wrapping it round a cylinder that one line is parallel to the axis, an arrangement which gives every possible subdivision of a circle between any given intervals. The figures are then observed by examining these lines through a narrow slit in a light opaque screen attached to a tuning-fork or reed vibrating in a plane parallel to the axis of the cylinder. This observing apparatus is moved parallel to that axis until the figure remains stationary, when the number of rotations is read off on a graduated scale. Conversely, if the number of rotations of the cylinder is known, the period of the tuning-fork can be determined. Incidentally Prof. McLeod explained a simple method of causing a fork to vibrate, and the manner in which they have succeeded in maintaining the vibrations of a reed. It was found that variations in temperature influence the determinations, inasmuch as they cause the period of the fork or reed to vary. When the former is used it becomes necessary to deduct 0·011 per cent. of the result for each degree centigrade of rise above the temperature for which the fork is set, and 0·0277 per cent. when employing a reed.

**Anthropological Institute**, April 24.—Mr. John Evans, F.R.S., president, in the chair.—Dr. John Rae read a paper on the migrations of the Esquimaux. The chief subjects of Dr. Rae's remarks were two papers read before the Ethnological Society, twelve years ago, the one by himself, the other by Mr. Clements R. Markham. Dr. Rae considered that Mr. Markham's present view was in accordance with what he (Dr. Rae) advanced in 1865, viz., that the route of the Eskimo must have been along the coast of America, across the Strait (northward) to Banksland, and thence to the Parry Islands, &c., where so many traces of them remain. He gave some information regarding various peculiarities of the Eskimos, and exhibited a stone lamp, with a curiously-shaped piece of stone, used for adjusting the wick, which consists of a species of fibrous moss (sphagnum) brought with the lamp from Repulse Bay more than twenty years ago. The lamp when lit gave a clear bright flame, from each of the three bits of moss used, without any perceptible smoke. These form valuable articles of barter by the Eskimos in the neighbourhood of such localities, with the more distant natives, for they seem to be in almost universal use, from Behring Strait eastward to Hudson Bay.—Mr. Robert B. Holt then read a paper on earthworks in Ohio, and Prof. Busk, F.R.S., described some skulls from the same place.—The following gentlemen took part in the discussions :—Mr. Hyde Clarke, Mr. Allen, the president, and others.

### PARIS

**Academy of Sciences**, April 30.—M. Peligot in the chair.—The following papers were read :—On a phenomenon of insolation of the eye, which has not hitherto been explained, by M. Chevreul. A few days before St. Bartholomew's day the Prince de Navarre (afterwards Henri IV.) being with the Duc d'Alençon and the Duc de Guise, at the Louvre, playing dice, they twice saw blood spots on the dice, whereupon they separated, in alarm. M. Chevreul explains the phenomenon as an effect of contrast of colours in sunlight, and gives some experiments in illustration. Material black appears red in reflecting white light.—On carbuncular disease, by MM. Pasteur and Joubert. Are the effects due to the bacteridium or to a virus? The bacteridium may be multiplied indefinitely in artificial liquids, without losing its action on the system, so we cannot suppose it accompanied with a soluble substance (or virus) producing, jointly with it, the carbuncular effects.—Probable consequences of the mechanical theory of heat, by M. Favé. He seeks to explain the phenomena attributed by M. Boutigny to the "spheroidal state," by supposing that the calorific waves of the sidereal ether have a repulsive action on ponderable matter. Take the case of a little water poured into a red-hot capsule. The heated metal gives radiant heat, *i.e.*, impresses the ether with waves which are rapidly propagated. This motion upwards counterbalances that due to the weight of the water. The distance between liquid and metal depends on the *vis viva* developed by the ether. The motion of oscillation is combined with one of varying rotation due to the resultant of the repulsive forces not passing through the centre of gravity of the globule.—On a new deposit of liquid mercury, indicated in the upper valley of l'Herault by M. de Quatrefages, by M. Leymerie.—On a new Arctic expedition of M. Nordenskjöld, by M. de Saporta. He intends prolonging his exploration as far as Behring Straits. The expedition is to leave Sweden in the summer of 1878.—Electro-silicic light, by M. Planté. He calls attention to the bright light produced when one or other electrode of his secondary batteries is applied to a tube or plate of glass. The glass is decomposed, and the luminous effect is probably due to incandescence of the silicium.—On a process of solidification of sulphide of carbon, by M. Mercier. Treating oils with a little protochloride of sulphur, a transparent solid matter is got, with nearly the elasticity of caoutchouc. If a volatile liquid be added at the moment of mixture, as benzine, oil of petroleum, or sulphide of carbon, the solidification takes place all the same, and the volatile liquid is imprisoned as in a net-work, from which it can only escape slowly. The mixture may hold even 70 per cent. of sulphide of carbon.—On the treatment of phylloxerised vines with sulpho-carbonate of potash, by M. Fatio.—On the rooting out of phylloxerised vines, by M. Cornu.—On the comparative structure of the roots of American and indigenous vines, and on the lesions produced by the phylloxera, by M. Foëz.—On the regeneration of phylloxerised vine-stocks by the employment of sulpho-carbonate of potash, by M. Gueyraud.—M. Dumas presented the first document from a Commission charged by the Emperor of Brazil, to determine the geographical positions of the principal points of the empire. It treats of the position of Barra do Pirahy, relatively to Rio de Janeiro Observatory.—Observations of Comets II. (Winnecke) and III. (Swift, Borrelly), by M. Wolf.—On some observations of solar spots, by M. Denza. This confirms M. Janssen's observations.—On the surfaces whose principal radii of curvature are functions of each other, by M. Mannheim.—Investigation of the law which a central force must follow for the trajectory which it produces to be always a conic, by M. Darboux.—On the laws of Kepler; solution of a problem proposed by M. Bertrand, by M. Halphen.—Reply to a note of M. Kirchhoff on the theory of elastic plates, by M. Levy.—Singular solutions presented in the problem of curvilinear motion of a point under the action of a central force, by M. Boussinesq.—On substances capable of being produced at a temperature above that which causes their complete decomposition, by MM. Troost and Hautefeuille. Examples are: protoxide of silver, ozone, protochloride of platinum, sesquichloride, protochloride, and subfluoride of silicium.—Process of industrial preparation of pure salts of alumina, by M. Ducla.—On monochlorised acetones, by M. Etard.—Experiments proving that the septicity of putrefied blood is due to figured ferments, by M. Feltz.—On the fixation of tannin by vegetable tissues, by M. Müntz. The tissue of champignons, especially, may be "tanned" into a kind of vegetable leather.—On gaseous exchanges between plants and the atmosphere; reply to critical observations of M. Barthelemy, by M. Merget.—Researches on the absorption and emission of gases by roots, by MM. Deherain and Vesque.—On the spontaneous and regular movements of a submerged aquatic plant, *Ceratophyllum demersum*, by M. Rodier.—On the presence of mercury in the springs of Rocher (Puy-de-Dôme), by M. Garrigou.—On a case of hereditary hemiteria, by M. Martinet.—On increase of the production of springs, by M. 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